Measure 1: Transit Travel Time

Monitoring Objectives

The purpose of monitoring transit travel times is to answer the following questions regarding transit travel times in the Seattle downtown core before and after tunnel closure:

- How long are the transit travel times in the Seattle downtown core?
- How consistent are the transit travel times in the Seattle downtown core?
- Where are slowdowns occurring and are there mitigation measures that might address these slowdowns?

Methodology

Transit travel times on surface streets were measured using roadside bus detection equipment at 16 locations in the Seattle downtown core. The locations of these detection points are identified in Figure 2. A description of the equipment and technology can be found in the Methodology section of the baseline tunnel closure report.

The collection of transit travel times began in summer 2005 and will be continuously collected throughout the tunnel closure period. Two levels of data are included in the regular performance reports issued by the Monitor and Maintain Committee:

Level 1: Seattle downtown core summary statistics will be the highest level summary. They consist of aggregated travel times through the study area to define an average transit operating time in the Seattle downtown core on surface streets for the AM peak and the PM peak. This measure will show the amount of time a bus takes on average to traverse the downtown area. Considered over time, this measure will give an overall trend of the increase or decrease in delay on surface streets caused by tunnel closure.

Level 2: Transit Corridor Travel Time summary will track travel time along a discrete set of transit corridors on surface streets in the central business district. The transit corridors included in the monitoring are identified in Figure 2. The data will be categorized by corridor and by time of day (AM Peak and PM Peak). Variability of the data will also be reported to show the consistency of transit travel times.

Figure 2. Transit Travel Time Summary Analysis Corridors and Detection Point Locations

Transit Travel Time Comparison

Data for transit travel time in the Seattle downtown core post tunnel closure is collected continuously. For this report, weekday travel times between June 5, 2006 and July 21, 2006 were used. This period was used to coincide with the summer 2006 service change that went into effect Saturday, June 3rd. Time of day periods, monitoring locations and analysis tiers, as described in the previous section, are the same as the baseline report except where noted.

In general, transit travel time averages on surface streets for this period were faster than the initial post-closure period results, and relatively unchanged from the previous report. Most corridor travel times improved or slowed slightly with a change in average travel time of less than one minute. The exception was First Avenue, which showed notable slowing, probably due to the impacts of Pioneer Square congestion. Overall, DSTT closure mitigation measures are benefiting CBD transit.

Seattle downtown core Travel Time Summary (Level 1):

The first level of analysis for downtown transit travel time is a composite measurement of average time spent in the study area. This value is obtained by identifying the first and last observation of a bus trip in the downtown core, regardless of the corridor. Averaging this figure for all trips results in a single value of time spent in the downtown core for all observed trips.

This value is used as an index, not a measure. This figure includes layover time as well as through-routed trips under one measurement. It will also include many different paths through the downtown core with different lengths and travel conditions. The measure becomes meaningful when compared to the same measurement in the future to compare the ease of travel for transit through the downtown core.

The baseline Travel Time Index is **100**, representing the value before tunnel closure. The average travel time value at that time was determined to be 21:59, based on bus trips between 4 - 6 pm on weekdays during the month of July, 2005. The data used for this reporting period covers the first seven weeks of the June 2006 service change. The Travel Time index for this reporting period is **77**, based on an average travel time of 16:55, and is relatively unchanged from the February 2006 index of 78, as reported in Volume 3. The current index represents a **23%** decrease in time spent in the downtown core over the baseline. The consistency between the February 2006 measurements and this analysis period confirm that CBD transit travel times have been consistent following post tunnel closure implementation of a set of contingency measures to deal with specific problem areas, such as Stewart Street. Please refer to Volume 3 of this report for a description of these contingency measures.

Transit Corridor Travel Time Summaries (Level 2)

The four charts in Figure 3 show the average travel times for transit after tunnel closure on selected corridors. The data was collected in June and July 2006 using the monitoring system. The data used is from weekdays only. Each chart shows the average travel time for the direction of travel and time of day indicated. The AM charts include buses observed between 7 – 9 am at the first reader on the corridor being measured. The PM charts cover the time period from 4 – 6 pm.

The average corridor travel times in this report are compared to the comparable statistics for both pre-tunnel closure baseline conditions and for the tunnel closure data reported in successive reports. Corridor travel times should not be compared to each other. Readers were placed to ensure route coverage. Readers were also sited to facilitate communications and insure access to power. As a result, the measured corridors differ in length, number of stops and number of signals, all of which affect travel time but are not related to congestion.

The reader locations that define the boundaries of each of the transit corridors are described below along with a table for each corridor that summarizes the Average Travel Time by time period along with the standard deviation (SD) of the observations in minutes. As a statistical measure, approximately 69% of all observations are within one standard deviation of the average. The SD can be interpreted as

approximating the range (+/- SD) of the typical travel time that a majority of bus riders will experience on the corridor. There are currently four data points; pre-tunnel baseline, and Volume 2, 3 and 4 post-tunnel closure observations.

Figure 3. Transit Corridor Travel Time after Tunnel Closure, July 2006

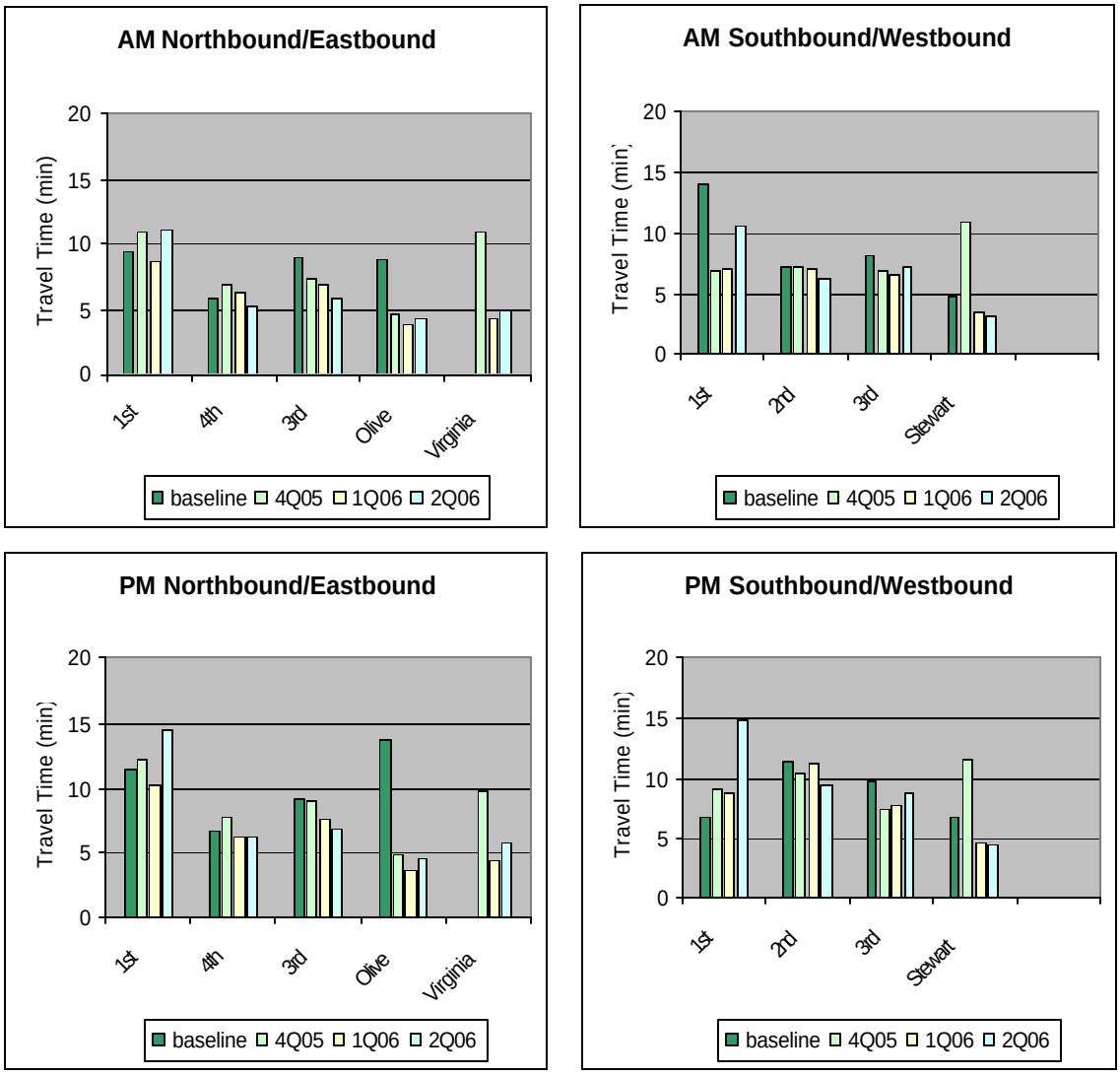

Figure 4A. First Avenue Transit Travel Time and Variation

First Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Northbound, Royal Brougham to Seneca Street	Travel time: Baseline – 9 min 22 sec *(SD: 4.8 min)* Volume 2 – 10 min 54 sec *(SD: 5.8 min)* Volume 3 – 8 min 36 sec *(SD:1.8 min)* Volume 4 – 11 min 8 sec *(SD:2.1 min)* *Change from Volume 3 : +2min 32sec*	Travel Time: Baseline – 11 min 24 sec *(SD: 5.3 min)* Volume 2 – 12 min 12 sec *(SD:6.0 min)* Volume 3 – 10 min 18 sec *(SD:3 min)* Volume 4 – 14 min 34 sec *(SD:4.3 min)* *Change from Volume 3 : +4min 16sec*
Southbound, Seneca Street to Royal Brougham*	Travel time: Baseline – 14 min *(SD: 8.8 min)* Volume 2 – 7 min *(SD: 5.4 min)* Volume 3 – 7 min 8 sec *(SD:1 min)* Volume 4 – 10 min 40 sec *(SD:1.8 min)* *Change from Volume 3 : +3min 32sec*	Travel time: Baseline – 6 min 51 sec *(SD: 3.9 min)* Volume 2 – 9 min 6 sec *(SD: 6 min)* Volume 3 – 8 min 49 sec *(SD:1.4 min)* Volume 4 – 14 min 55 sec *(SD:3 min)* *Change from Volume 3 : +6min 6sec*

First Avenue (Northbound and Southbound) reader locations are Royal Brougham to the south and Stewart Street to the north, with a midpoint at Seneca Street. Average and variation in travel time on First Avenue increased notably. The largest increases were in the PM Peak period, especially in the southbound direction. This increase is most likely due to SR519 project construction, and the impact of baseball traffic on Pioneer Square. The relatively low number of observed trips on this corridor and the high standard deviation may have produced an exaggerated result, but average travel times are definitely longer than the previous period.

Figure 4B. Second Avenue Transit Travel Time and Variation

Second Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Southbound, Pike Street to S Jackson Street	Travel time: Baseline – 7 min 20 sec *(SD: 1.9 min)* Volume 2 – 7 min 13 sec *(SD: 2.6 min)* Volume 3 – 7 min 11 sec *(SD:1.45 min)* Volume 4 – 6 min 13 sec *(SD:1.5 min)* *Change from Volume 3 : -58sec*	Travel time: Baseline – 11 min 26 sec *(SD: 4.3 min)* Volume 2 – 10 min 26 sec *(SD: 3.5 min)* Volume 3 – 11 min 10 sec *(SD:2.4 min)* Volume 4 – 9 min 22 sec *(SD:2.2 min)* *Change from Volume 3 : -1min 48sec*

Second Avenue (Southbound only) reader locations are Pike Street and S Jackson Street with a midpoint at Seneca Street. Second Avenue improved in average travel time with effectively no change in variation. Because this measurement is for the entire length of Second Avenue, it does not capture the sometimes significant delays for transit turning right at Columbia Street to access SR99 southbound.

Figure 4C. Third Avenue Transit Travel Time and Variation

Third Avenue	AM Peak (7 – 9 am)	PM Peak (4 – 6 pm)
Northbound, Yesler Way to Stewart Street	Travel time: Baseline – 9 min *(SD: 4.6 min)* Volume 2 – 7 min 20 sec *(SD: 3.1 min)* Volume 3 – 6 min 53 sec *(SD:1.3 min)* Volume 4 – 5 min 53 sec *(SD:1.3 min)* *Change from Volume 3 : -1min*	Travel Time: Baseline – 9 min 6 sec *(SD: n/a)* Volume 2 – 8 min 57 sec *(SD: 3.6 min)* Volume 3 – 7 min 41 sec *(SD:1.3 min)* Volume 4 – 6 min 53 sec *(SD:1.8 min)* *Change from Volume 3 : -48sec*
Southbound, Stewart Street to Yesler Way	Travel time: Baseline – 8 min 5 sec *(SD: 1.3 min)* Volume 2 – 6 min 52 sec *(SD: 2.8 min)* Volume 3 – 6 min 36 sec *(SD:1.6 min)* Volume 4 – 7 min 17 sec *(SD:1.5 min)* *Change from Volume 3 : +41sec*	Travel time: Baseline – 9 min 45 sec *(SD: 2.5 min)* Volume 2 – 7 min 27 sec *(SD: 2.9 min)* Volume 3 – 7 min 51 sec *(SD:1.5 min)* Volume 4 – 8 min 46 sec *(SD:1.8 min)* *Change from Volume 3 : +55sec*

Third Avenue (Northbound and Southbound) reader locations are Stewart Street to the north and Yesler Way to the south, with a midpoint at Seneca Street. Average travel times improved in the northbound direction and slowed in the southbound direction compared to the previous report. Variation was similar to the previous period. Travel times and variation in both directions and peak periods are improved over the pre-closure conditions.

Figure 4D. Fourth Avenue Transit Travel Time and Variation

Fourth Avenue	**AM Peak (7 – 9 am)**	**PM Peak (4 – 6 pm)**
Northbound, S Jackson Street to Seneca Street	Travel time: Baseline – 5 min 48 sec *(SD: 1.2 min)* Volume 2 – 6 min 58 sec *(SD: 2.8 min)* Volume 3 – 6 min 14 sec *(SD:1.35 min)* Volume 4 – 5 min 12 sec *(SD:1.2 min)* *Change from Volume 3 : -1min 2sec*	Travel Time: Baseline – 6 min 46 sec *(SD: 1.1 min)* Volume 2 – 7 min 50 sec *(SD: 4 min)* Volume 3 – 6 min 15 sec *(SD:2 min)* Volume 4 – 6 min 11 sec *(SD:2.2 min)* *Change from Volume 3 : -4sec*

Fourth Avenue (Northbound only) reader locations are Seneca Street to the north and S Jackson Street to the south. Average travel times decreased by one minute during the morning peak period, with effectively no change in variation for either the morning or evening peak. Average travel times are a half minute below the pre-closure baseline with similar variation.

Figure 4E. Virginia, Olive Way and Howell Transit Travel Time and Variation

	AM Peak (7 – 9 am)	**PM Peak (4 – 6 pm)**
Eastbound Virginia, Third Avenue to Ninth Ave	Travel time: Volume 2 – 10 min 39 sec *(SD: 5.1 min)* Volume 3 – 4 min 23 sec *(SD : .9 min)* Volume 4 – 4 min 53 sec *(SD .9 min)* *Change from Volume 3 : +30sec*	Travel Time: Volume 2 – 9 min 50 sec *(SD: 4.9 min)* Volume 3 – 4 min 28 sec *(SD:1 min)* Volume 4 – 5 min 48 sec *(SD:2.4 min)* *Change from Volume 3 : +1min 20sec*
Eastbound Olive Way, Third Avenue to Eighth Ave	Travel time: Baseline – 8 min 42 sec *(SD: 9.1 min)* Volume 2 – 4 min 34 sec *(SD: 2.4 min)* Volume 3– 3 min 54 sec *(SD : 1 min)* Volume 4 – 4 min 19 sec *(SD:1 min)* *Change from Volume 3: +25sec*	Travel Time: Baseline – 13 min 43 sec *(SD: 9.7 min)* Volume 2 – 4 min 51 sec *(SD: 2.5 min)* Volume 3 – 3 min 41 sec *(SD : .9 min)* Volume 4 – 4 min 34 sec *(SD: 1.45 min)* *Change from Volume 3 : +53sec*
Eastbound Howell, Eighth Ave to Yale Street	Travel time: Baseline – 2 min 6 sec *(SD: 1.4 min)* Volume 2 – 3 min 53 sec *(SD: 2.4 min)* Volume 3 – 3 min 23 sec *(SD :1.6 min)* Volume 4 – 3 min 3 sec *(SD: 1.25 min)* *Change from Volume 3 : -20sec*	Travel Time: Baseline – 5 min 25 sec *(SD: 3.1 min)* Volume 2 – 5 min 37 sec *(SD: 3.3 min)* Volume 3 – 4 min 50 sec *(SD:2.3 min)* Volume 4 – 5 min 23 sec *(SD:2.5 min)* *Change from Volume 3 : +33sec*

Virginia Street (Eastbound only) reader locations are Third Avenue at Stewart to the west and Ninth Avenue at Stewart to the east. Virginia Street was not a transit routing before the tunnel closure, so there is no baseline data. Average travel times increased by 30 seconds in the AM, and a minute 20 seconds in the PM. AM variation held constant, but the PM variation increased notably suggesting the corridor experienced several high-congestion incidents during the measurement period.

Olive Way (Eastbound only) reader locations are Third Avenue to the west and Eighth Avenue to the east. Average travel times slowed by 25 seconds in the AM, and nearly a minute in the PM on Olive Way between Third and Eighth Avenues. Like Virginia Street, the PM variation increase was significant and indicates several high-congestion incidents occurred during the measurement period.

Howell (Eastbound only): Transit on Howell east of Eighth Avenue improved slightly in the morning, slowed slightly in the evening, with variation staying fairly consistent. While consistent, PM variation is nearly 50% of the average travel time indicating this segment can be a source of significant delay.

Figure 4F. Stewart Street Transit Travel Time and Variation

	AM Peak (7 – 9 am)	**PM Peak (4 – 6 pm)**
Westbound, Ninth Avenue to Third Avenue	Travel time: Baseline – 4 min 50 sec *(SD: 1.9 min)* Volume 2 – 10 min 52 sec *(SD: 5.2 min)* Volume 3 – 3 min 31 sec *(SD:1 min)* Volume 4 – 3 min 8 sec *(SD: 1.5 min)* *Change from Volume 3 : -23 sec*	Travel Time: Baseline – 6 min 42 sec *(SD: 1.5 min)* Volume 2 – 11 min 36 sec *(SD: 4.9 min)* Volume 3 – 4 min 42 sec *(SD: 2 min)* Volume 4 – 4 min 32 sec *(SD: 2.5 min)* *Change from Volume 3 : -10 sec*

Stewart Street (Westbound only) reader locations are Third Avenue to the west and Ninth Avenue to the east. Average travel time was consistent with the improvements seen in the previous report following the implementation of additional mitigation measures. The current average travel times are now one to two minutes faster than the pre-closure baseline. Variation was also consistent with the previous period.